

MANAGING CHEMICALS

From Hospitals and Biomedical Labs

LABORATORY SPILL PROCEDURES



If you accidentally spill a radioactive, biohazardous or chemically hazardous material, there are some special procedures you should follow to make sure things don't get worse before they get better.

First of all, if there is an emergency or if anyone is in danger, immediately call 911! Emergency personnel will be dispatched to help you.

If, however, there is no immediate threat to health, you should use your best judgment to decide whether to call for help or to address the matter yourself. The guidelines below are intended to help you make this decision.

Being forewarned is being forearmed! Having a well thought-out chemical spill kit or biological materials spill kit stored in a suitable place and updated regularly will not only make accident clean-up easier, but will significantly add to peace of mind in the workplace. Clean-up materials are required in every laboratory, so make it a priority to put a good spill kit together.

Step 1: Prioritize

- First, again, call 911 for help if there's an emergency!
- Second, determine exactly what it is you've spilled. Most of the time you'll only have one type of dangerous material at a time. However, if the spilled material contains a mixture of chemical, biological, and radioactive material, consider the threats separately and address them in the following order:
 1. **Chemical Hazards:** Many chemicals can cause immediate injury -- address these first!
 2. **Biological Hazards:** Biohazardous materials must first enter the body through a specific exposure route. Once in the body the host's immune response determines whether or not infection will take place. Knowing the identity of the infectious agent and the route of exposure is essential in being able to clean up spilled biohazardous materials safely. Address these second!
 3. **Radioactive Hazards:** Radioactive materials, though rarely pose an immediate threat in the University environment, they are heavily regulated, can spread very easily, and can be difficult to clean. Time of exposure and distance from the material are key factors in determining a dose (the shorter the exposure time and the further away from it you are, the smaller the dose). Address these as soon as you can!

Step 2: Take the appropriate steps

Once you know what kind of substance you're dealing with, there are special techniques to use to deal with the spill

Chemical Spills

Education and Prevention

The best way to deal with a chemical spill is to be educated. Your internal training should cover aspects such as:

- Chemical hazards
- Risk assessment
- Personal protection
- Spill clean-up procedures
- Regulatory requirements

Consider getting a proactive audit of your lab safety program and chemical spill readiness by contacting a governmental or private environmental consultation program. An outside perspective often helps.

Chemical Spill Basics

Hazardous material spills that do not endanger workers in the immediate area may be cleaned up by area personnel who have been trained and are properly equipped to clean up the spilled material safely. Hazardous material spills that cannot be safely adsorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area are considered to be emergencies requiring outside assistance, typically by your local Fire Department, on-site Environmental Health & Safety (EH&S) staff, and possibly a spill cleanup contractor.

When in doubt about whether you need help or not, it is best to call for help.

Major Chemical Spills

Pull the Fire Alarm or call 911

A major chemical spill is:

- One that has caused injury to personnel or is likely to cause injury, or
- Uncontained and spreading out of the immediate area endangering other labs, or
- Has the potential to cause a fire.

Pull the fire alarm if someone has been injured. This is the fastest way to get help and alert others nearby of the emergency. The Fire Department is the primary responder for major chemical spills.

If you can answer YES to the following 4 questions, it is safe for you to clean up the spill:

1. Do you know what chemical was spilled?
2. Do you know the hazards of the spilled chemical?
3. Do you have a chemical spill kit?
4. Can you protect yourself from these hazards?

If you answered NO to any of the above questions or need assistance with the spill cleanup, evacuate the area and call your EH&S coordinator, your spill response contractor or the fire de-

Chemical Spill Kits

All laboratories must have spill clean up materials available. Spill kits and replacement parts are available from many lab safety supply companies. A complete spill kit such as the one listed below may be purchased for less than \$100.

Adsorbent	Neutralizing Materials	Misc. Containers/Supplies	Misc. Protective Gear
5 Spill pads, universal for acid, base, oil, solvents	1 box baking soda	4, 20 x 30", heavy duty (6mm) plastic bags 1 five gallon reusable screw top plastic drum. Good to store all kit supplies and later used to hold bagged plastic spill waste for pickup. Snap together dust pan and whisk broom	1 goggle, chemical splash 1 pair heavy-duty nitrile gloves 8 pairs of Microgrip powder free nitrile gloves, chemical resistant, in various sizes, allows for dexterity.

Respirators may be necessary for spill clean up. The use of respirators requires prior medical evaluation, training, and fit testing.

Biohazardous Spills

Each lab coordinator should be responsible for developing spill clean-up procedures that are appropriate for the materials used in the laboratory, as well as assuring that a spill kit is assembled and placed in a strategic location outside of, but near to, an area where a spill could occur. Furthermore, anyone working with biological materials must receive training in spill clean-up appropriate for materials routinely used.

Use the following procedures to deal with a spill of biohazardous materials, either inside a Biological Safety Cabinet, or outside of one:

Biohazard Spills Outside a Biological Safety Cabinet

- Hold your breath, leave the room immediately, and close the door. One good way to identify the spill area is to drop your laboratory coat on the area;
- Warn others not to enter the contaminated area;
- Remove contaminated garments and put them into a container for autoclaving. Thoroughly wash your hands and face and any other exposed areas of the body. **If the spill involves potential exposure of bloodborne pathogens**, follow your facility's bloodborne pathogen policy for managing and reporting these exposures;
- Wait 30 minutes to allow dissipation of aerosols created by the spill if in a laboratory where the airflow is negative relative to the surrounding areas. For spills in other areas, it may be appropriate to begin the clean-up immediately after assembling the needed clean-up materials;
- Put on a long-sleeve gown, mask, and rubber gloves before re-entering the room. For a high risk agent, a jumpsuit with tight-fitting wrist seals and use of a respirator should be considered;
- Pour a decontaminant solution appropriate for the agent involved (e.g. household bleach is an appropriate decontaminant for human blood and body fluids) around the spill and allow to flow into the spill. Paper towels soaked with the decontaminant may be used to cover the area. To minimize aerosolization, avoid pouring the decontaminant solution directly onto the spill;
- Let stand for 20 minutes to allow an adequate contact time;
- Using an autoclavable dust pan and squeegee, transfer all contaminated materials (paper towels, glass, liquid, gloves, etc.) into a deep autoclave pan. Cover the pan with aluminum foil or other suitable cover and autoclave according to standard directions. Reusable items should be separated from non-autoclavable plastic, as the plastic will melt and will then be impossible to remove from other items in contact with them.

Biohazard Spills Inside a Biological Safety Cabinet

In order to prevent escape of contaminants from the cabinet and while the cabinet continues to operate, chemical decontamination procedures are recommended and should be initiated at once.

- Spray or wipe walls, work surfaces, and equipment within the cabinet with a solution of an appropriate decontaminant for the agent involved. If the gloves being used are not puncture resistant, additional care is necessary if the spill involves broken glass or other sharp material;

(Biohazardous Spills continued)

- Flood the top work surface tray and, if it is a Class II biological safety cabinet, the drain pans and catch basins below the work surface with the decontaminant and allow to stand for 10-15 minutes. The contact time should be extended to 30 minutes for large spills or spills containing large amounts of proteinaceous material;

Remove excess decontaminant from the tray by wiping with a sponge or cloth soaked in decontaminant. For Class II biological safety cabinets, drain the tray into the catch basin below the work surface, lift out the tray and removable front intake grille, and wipe off top and bottom (underside) surfaces with a sponge or cloth soaked in a decontaminant. Replace the grille and drain decontaminant from the cabinet base into an appropriate container and autoclave according to standard procedures. Be sure to place gloves, cloth, and/or sponge into an autoclave pan to be autoclaved.

***Spills Outside the Laboratory (During Transport)**

If a biohazardous agent is spilled during transport outside the laboratory, the main difference from the first procedure is to initiate the cleanup **immediately**. Otherwise, use those procedures. Because it would already be too late to prevent aerosolization in this case, it is better to place extra emphasis on prevention of spills during transport:

- Develop a procedure for the removal of biohazardous materials for incubation, refrigeration, or for any other reason from the laboratory, and enforce adherence to it;
- Place all such materials in an unbreakable container that would prevent the escape of liquid or aerosol if it were dropped. One-gallon or half-gallon paint pails are good examples of acceptable containers;
- Label the container with the biohazard symbol to ensure no mistake is made as to the contents.

**Information taken from "Laboratory Safety, Principles and Practices, Second Edition", Chapter 14, "Decontamination, Sterilization, Disinfection, and Antisepsis" by Donald Vesley and James L. Lauer.*

Biohazard Spill Kit

A well designed spill kit is highly recommended. It can save injury, time, and resources. The following items would be excellent choices for a Biohazard Spill Kit:

- **An appropriate chemical decontaminant** -- in most cases a 10% household bleach solution is a good choice, but keep in mind that bleach will corrode stainless steel if left in contact with it for 30 minutes or more. For human blood and body fluids, iodophors or 70% alcohol is appropriate;
- **Materials to absorb liquids after decontamination** -- this could include paper towels, absorbent lab pads, or special materials designed to absorb large volumes of liquid. Keep in mind the volumes of liquid typically used in the laboratory area when selecting an absorbent;
- **Appropriate personal protective equipment to wear during clean-up** -- gloves and a long-sleeved laboratory coat or gown are always necessary. Facial protection should be considered for large spills as well as protection against splash and splatter of the chemical decontaminant. Additional personal protective equipment is necessary when working with Class 3 agents.

(*Biohazardous Spills continued*)

- **A mechanical means for handling broken glass** -- this could include tongs, forceps, small disposable scoops and sponges, autoclavable dust pans, or any other method that prevents direct contact with the broken glass. Broken glass represents a high cutting danger and should not be touched directly, especially if it is contaminated with a biohazardous agent;
- **Biohazard bags, sharps containers, and/or other containers to place the material in for further treatment and disposal.**

Mercury Spills

Mercury spills are one of the most common chemical spills. Thermometers, manometers, blood pressure cuffs, and many other instruments contain elemental mercury and are easily broken. Fortunately, mercury is simple to clean up and poses little risk to your health *unless* it is spilled within heated devices or gets trapped in upholstery, carpeting, or other surfaces where there is an increased likelihood of human contact.

Health Hazards

- Mercury is an inorganic element that is readily absorbed via the respiratory tract (as in elemental mercury vapor or mercury compound dust form), gastrointestinal tract, and skin surface. Fortunately, at room temperature mercury is not very volatile and poses little risk. If spilled on a heated surface, however, its volatility increases and therefore the risk of inhalation. Mercury spilled on fabric or carpet is also very difficult to clean and can also pose an increased risk of inhalation.
- Mercury in the organic form is extremely toxic via skin contact, inhalation, and ingestion. These compounds target the central nervous system and can lead to brain damage, tremors, speech impediments, blindness, and death.
- Be mindful of your accessories - jewelry can be ruined by contact with metallic mercury.

Mercury Spill Kits and Assistance

There are several different products available that are appropriate for cleaning up mercury spills.

Example Mercury Spill Kit	
Number	Item
3	Large Nitrile Gloves
3	Ziplock Bags 9x13
1	Pkg. Cloth Sponges
3	Syringe Aspirator
1	500 g Hg Absorbent Powder
3	Small Scoop-Scraper

How to handle a variety of spill situations

Mercury thermometer spills on smooth surfaces:

1. Isolate the area by marking off the spill section to prevent inadvertent spreading of the mercury.
2. Wear 2 pairs of chemical resistant gloves (nitrile or silver shield), lab coat, and eye protection during cleanup operations.
3. Using a scraper, push the scattered mercury droplets together into a larger droplet.
4. Aspirate the larger mercury droplets and place them into a zip lock bag or screw top container.
5. Sprinkle mercury absorbent powder lightly over the remaining micro-droplets of mercury.
6. Spray a water mist over the powder.
7. Using the scraper, mix the materials into a paste amalgam. The resulting substance will not emit dangerous mercury vapors.
8. Scoop up the amalgam and wipe down the surfaces with a scraper and damp sponge. Place the amalgam, sponge, gloves, scraper, scoop, and all other mercury contaminated debris into the zip lock bag or container. Tape sharp ends of the glass thermometer and place it into the bag or container as well.
9. Label the bag or container with a hazardous waste label.

Mercury manometer spills on any surface and mercury spills on porous surfaces (carpet, upholstery, concrete, etc.):

The preferred method to clean up large mercury spills on any surface or any size mercury spill on porous flooring or carpeting is the use of a mercury vacuum. In some instances the surface cannot be cleaned or decontaminated. Carpets and fabrics are typically disposed of as hazardous waste. Post clean-up monitoring should also be conducted.

Mercury spills in ovens, incubators, hot water baths or other elevated temperature situations:

When the spill occurs in equipment with elevated temperature conditions such as an oven or incubator, an exposure to mercury vapor is more likely.

- Shut off the equipment and leave the area immediately.
- The cleanup should be performed after the device has cooled.
- Mercury vapor monitoring must be performed prior to any cleanup.
- Continued mercury vapor monitoring will need to be conducted after the cleanup is complete.

Large mercury spills:

A broken manometer or other large mercury spill will require use of a mercury vacuum and mercury monitoring. Monitoring should be part of the evacuation process and care should be taken to help isolate the spill area and prevent spreading. Post clean-up monitoring should also be conducted.

Radioactive Materials Spills

Spills of radioactive materials are classified into two categories, **Major Spills** and **Minor Spills**, based on the amount of material spilled.

1. Consult the nuclide chart below and determine which **Group** the spilled radionuclide belongs to.
2. Estimate the amount of radioactivity, in millicuries, that has been spilled.

Look at the criteria for **Major Spills** and **Minor Spills** below to decide which set of procedures you should follow.

Group 1	Group 2			Group 3		Group 4
ALI > 10 mCi	1 mCi < ALI < 10 mCi			0.1 mCi < ALI < 1 mCi		0.01 mCi < ALI < 0.1 mCi
H-3	C-14	Mn-54	Mo-99	Na-22	Sr-89	Sr-90
F-18	Na-24	Fe-55	In-111	P-32	Cd-109	I-125
Cr-51	P-33	Co-57	I-123	Cl-36	Ag-110m	I-131
Cu-64m	S-35	Co-58	Hg-197	Ca-47	Cd-115m	
Tc-99m	K-42	Ga-67	Au-198	Fe-59	Ir-192	
In-113m	Ca-45	Hg-203(inorganic)	Zn-65	Hg-203(organic)		

(ALI = Annual Limit on Intake)

Major Spills

Criteria: *Group 1 > 10 mCi ; Group 2 > 1 mCi ; Group 3 > 0.1 mCi : Group 4 > 0.01 mCi*

Actions to take:

1. **CLEAR THE AREA.** Notify all persons not involved in the spill to vacate the room.
2. **PREVENT THE SPREAD.** Cover the spill with absorbent pads or diatomaceous earth, but **do not attempt to clean it up.** Confine the movement of all personnel potentially contaminated to prevent the spread.
3. **SHIELD THE SOURCE.** If necessary, the spill should be shielded, but only if it can be done without further contamination or without increasing or significantly increasing your radiation exposure.
4. **CLOSE THE ROOM.** Leave the room and lock the door(s) to prevent entry.
5. **CALL FOR HELP.** Notify the Radiation Safety Officer immediately.

(Radioactive Materials Spills continued)

Minor Spills

Criteria: *Spills less than major spill quantities*

Actions to take:

1. **NOTIFY.** Notify persons in the area that a spill has occurred.
2. **PREVENT THE SPREAD.** Cover the spill with absorbent paper or spread diatomaceous earth.
3. **CLEAN UP.** Use disposal gloves and remote handling tongs. Carefully fold the absorbent paper and pad. Scoop up any absorbent diatomaceous earth with cardboard. Insert it into a plastic bag and dispose of it in the radioactive waste container. Also insert into the plastic bag all other contaminated materials such as disposable gloves.
4. **SURVEY.** With a low-range, thin-window GM Survey meter, check the area around the spill, hands, and clothing for contamination. Survey H-3 and C-14 spills with wipes counted in a Liquid Scintillation Counter.
5. **REPORT.** Report the incident to the Radiation Safety Officer.
6. **PERSONNEL DECONTAMINATION.** Contaminated clothing should be removed and stored for further evaluation by the Radiation Safety Officer. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water.

This fact sheet was created by the Medical Industry Waste Prevention Roundtable as part of a seminar series designed to help medical industry professionals control costs through product stewardship and waste reduction. Please pass this sheet on to others who maybe interested.

Medical Industry Waste Prevention Roundtable



What is the Medical Industry Waste Prevention Roundtable? The Roundtable was established in early 1999 to bring together medical industry professionals who are interested in exchanging ideas on, and developing new ways of, preventing and reducing waste. During 2000 and 2001 the group is hosting a series of seminars to develop cost-effective, environmentally sound solutions for managing major medical wastes such as products and packaging.

The Medical Industry Waste Prevention Roundtable is sponsored by:



For more information on the Roundtable, visit our Web site at http://dnr.metrokc.gov/swd/bizprog/waste_pre/medical.htm or contact Kinley Deller at (206) 296-4434 or kinley.deller@metrokc.gov.